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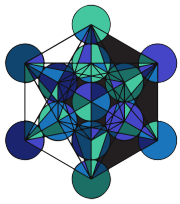
Post Planetary Design
Final Paper



A Speculative Blockchain Lifeform for Distributed Space Exploration

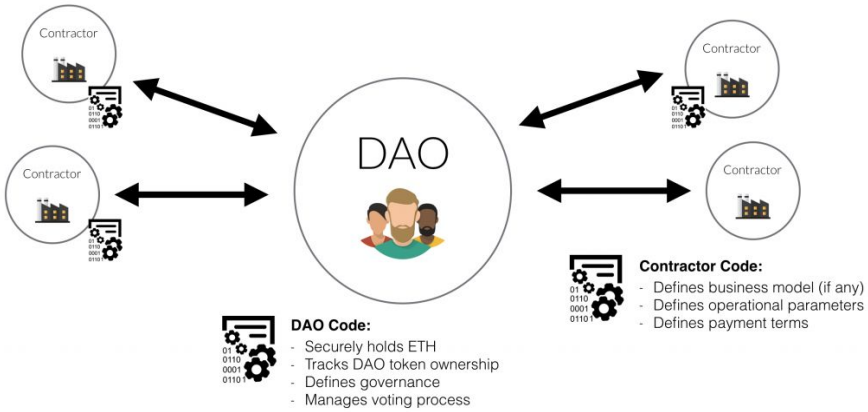
Space has always been a canvas upon which humanity paints their dreams for a radically different future. Literature, movies, comics, and music have articulated this trend, representing a landscape of competing goals, priorities, and ideologies that is bounded on one side by visions of the perfect utopia and on the other by cautionary dystopian scenarios portraying a recapitulation of today's horrors on a grand and alien scale. Until recently, this wasn't a problem. Space was equally unreachable by all. But within the last century, space - at least near-space- is becoming a perceivable and tangible place instead of just a vehicle for stories about the future. And with this shift in perspective comes an equal shift in rights and reason. Why should we go to space? Who owns space? Who can use space? What can space be used for? While these questions have been answered time and time again through fiction, they now must be answered for real, throwing people's and organization's diverse visions for space into stark relief and creating an urgency for setting rules and guidelines, or deciding to do away with them completely.

For our final project, Erica Kermani and I sought to address this critical need, reviewing the legal precedents and commercial priorities that have began to emerge and critiquing and comparing the language they use and stories they tell. What we found is a strong tension between the historical legal precedent of space as commons, a place where every country and person should have an equal right to explore and benefit from in some way, and the practical reality of space as an expensive but potentially profitable business opportunity - and the laws being written to push this view forward.

I quickly realized that my opinion on what space should be used for is not any better or more correct than anyone else's, and to claim so was the ultimate hubris responsible for creating real dystopias even as 'utopias' are supposedly being built. For this reason, my interest in this project was focused not on defining an alternative narrative for space, something to fundamentally oppose the emerging commercial and capitalist perspective of space as resource to extract or a frontier to conquer and tame, but rather understanding what types of platforms and organizational structures could allow a more diverse range of actors to competitively put their preferred goals for space forward. Furthermore, I wanted this particular design intervention to be 'xenosectionalist' meaning that it could encompass and enfold non-human perspectives and organizational models in order to redefine and compensate for human-centric definitions of sovereignty and access. I am terrified by my own inability to let go of humanity, human survival, and human benefit as the ultimate priority for the future. Try as I might, I find anger, hostility,

and protectiveness rising unbidden whenever the alien is poised to take control of human agency, even if I know intellectually, that the alien might represent a better future for a greater number of living beings (e.g. The Southern Reach trilogy, Solaris). Given my own emphatic tendency towards tribalism when confronted by the other, I am not sure if the human will alone should reign sovereign anywhere off planet. If our first instinct towards trans/post/extra-human transformation is violence, then maybe we shouldn't be allowed off-planet at all. As such, my main design question was how we might decenter the human identity, will, and ego as the framework for space exploration and utilization. How might we include non-human and alien agents from the get-go, potentially creating a foundation for dealing with radically different extraterrestrial intelligences we might encounter?

Given my extensive research into emerging financial and economic technologies and Erica's interest in perpetuating and giving equal access to diverse groups and opinions, we decided that the blockchain protocol could present one possible avenue for exploration. Simply put, the blockchain protocol is a software mechanism that "…provides a distributed system of trusted assets and transactions without the need for a central trust authority."[1] At its core, the blockchain is a self-sustaining, peer-to-peer database that can manage and record transactions without a clearinghouse to prevent the double spending problem inherent in digital information and assets. Blockchains can also run code. Today's blockchains can execute smart contracts, computer programs that not only define the rules and penalties around an agreement just like a regular contract, but automatically enforce those obligations using code.[2] Given that smart contracts are self-executing, they enable a new type of distributed organization and governance that is purely autonomous, meaning that all the rules, agreements, and organizational guidelines (voting, profit-sharing, buying/selling etc.) and agreements can be encoded beforehand and hence managed by a software agent. When a particular clause is activated, a smart contract or group of smart contracts can automatically execute the proper response in a distributed manner, where all nodes participating in a blockchain network validate proof that a condition was met. This means that once deployed, the organization (or code) cannot be altered or shut down by any single party, in essence, taking on a life of its own.



[1] Prasad Satyavolu and Abhjeet Sangamerkar, "Blockchain's Smart Contracts: Driving the Next Wave of Innovation Across Manufacturing Value Chains," Cognizant 20-20 Insights, June 2016, 1, accessed March 24, 2017.

[2] Stark, Josh. "Making Sense of Blockchain Smart Contracts." CoinDesk. June 07, 2016. Accessed May 13, 2017. http://www.coindesk.com/making-sense-smart-contracts/.

The idea of a distributed autonomous organization (DAO) already exists today, representing a kind of predetermined collective artificial intelligence that replaces the purely-human intelligence in today's corporate structure. Instead of having humans continue to define and redefine what success is throughout a company's lifetime, a DAO defines these successes ahead of time according to the collective will of its creators. Business objectives, or social objectives, can be written as functions with particular inputs and outputs.

For example…

```
function company(shares, objective1, objective2, constraint1, constraint2) {

        while (remainingShares.length > 0) {
                distributeShares(sharePrice, numberSharesSold)
                remainingShares = remainingShares - numberSharesSold;
        }

        if(objective 1 == true) {
                if (constraint1 != true && constraint2 != true) {
                        executeAction1();
                }
        }

        if(objective 2 == true) {
                if (constraint1 != true && constraint2 != true) {
                        executeAction2();
                }
        }

        else() {
                return;
        }
}
```

Already, Ethereum has listed public code for a DAO structured as a congress, a shareholder organization, a liquid democracy, a house of representatives, and an executive branch.[3]

This aspect of the blockchain is fascinating. Not because it represents a radical new potential for flexible and distributed governance (which it does) but because it actually calls into question what an 'organization' means. Stripped down, the interactions of any modern corporation, government body, or group of humans working together can be redefined as code, as program. This shift in perspective may seem menial, but I think it is actually the most revolutionary aspect of blockchain technology. When we can shift our perspective to view human social interactions as a set of digital rules and protocols, we actually become self-alienated at scale, using non-human digital structures to define collective human action.

Earth-bound civilizations are messy, bureaucratic, and mired in history and tradition, meaning they are unlikely to crumble before the onslaught of distributed organizations. But space is still a blank canvas in many regards, with no existing rules or protocols outside of the limited legal frameworks outlined earlier. Perhaps space is the place DAOs could really flourish, allowing more people to collectively organize and achieve a variety of goals and priorities. Using this speculation as a foundation, I wanted imagine how this could work in practice.

To do so, I turned to a relatively unknown DAO called Plantoid that was created by Primavera De Filippi, a research fellow at the Berkman Center for Internet & Society at Harvard University. Broadly, a Plantoid is the plant equivalent of an android, rather it's a synthetic organism that is designed to look, act, and grow like a real plant. However, given that plantoids

[3] "Create a Democracy contract in Ethereum." Ethereum Project. Accessed May 13, 2017. https://www.ethereum.org/dao.

mimic plants, they represent a radically non-human intelligence. Just like plants, plantoids incorporate distributed architectures that consist of autonomous and specialized modules that can be modeled on different types of plant parts or networks, combining to form a type of swarm intelligence. This type of networked artificial intelligence could theoretically support unmanned, undirected exploration, using internal homeostasis, reconfiguration and sensor fusion to provide them a collective environmental awareness allowing for the autonomous harvest, management and sale of information, energy and resources..[4]

Philippi's Plantoid project builds off of this model, creating an:

"...autonomous blockchain-based lifeform that is able to reproduce itself...a hybrid creature that lives both in the physical world (as a mechanical contraption made up of recycled steel and electronics) and in digital world (as a software deployed on top of a blockchain-based network)." The goal of the Plantoid is to illustrate one of the most revolutionary—and yet still unexplored—aspects of blockchain technology. It illustrates the ability to create "blockchain-based lifeforms", i.e. algorithmic entities that are: autonomous, self-sustainable, and capable of reproducing themselves, through a combination of blockchain-based code and human interactions."[5]

While Philippi's Plantoids are purely artistic, mechanical sculptures that request Bitcoin from passersby, rewarding them with visual or auditory displays when they donate, I wanted to understand how we could adopt this model as a human/non-human funding and organizational structure capable of "seeding ideas and projects' that can articulate a diverse and distributed set of individual goals and priorities for space, mediated by a radically non-human intelligence.

Our final project, Archeon, is an attempt to outline what this technology could look like, a proposal to leverage DAOs as a new method for the collaborative funding, implementation, and value-sharing of plantoids for near-space exploration. Archeons are created as cooperative space exploration machines, whether a satellite, probe, biosphere, or ship. The creators of an Archeon build the machine with their own investment and set the rules by which people can interact with it once launched. People can interact with an Archeon by sending crypto-currency - which could theoretically be earned a variety of ways in the future (working, volunteering,

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[4] Mazzolai, Barbara, Cecilia Laschi, Paolo Dario, Sergio Mugnai, and Stefano Mancuso. "The plant as a biomechatronic system." *Plant Signaling & Behavior*5, no. 2 (February 5, 2010): 90-93. Accessed May 13, 2017. doi:10.4161/psb.5.2.10457. 39.

[5] De Filippi, Primavera. "I'm a PLANTOID." Plantoids: Blockchain-based life forms. Accessed May 13, 2017. http://okhaos.com/plantoids/.

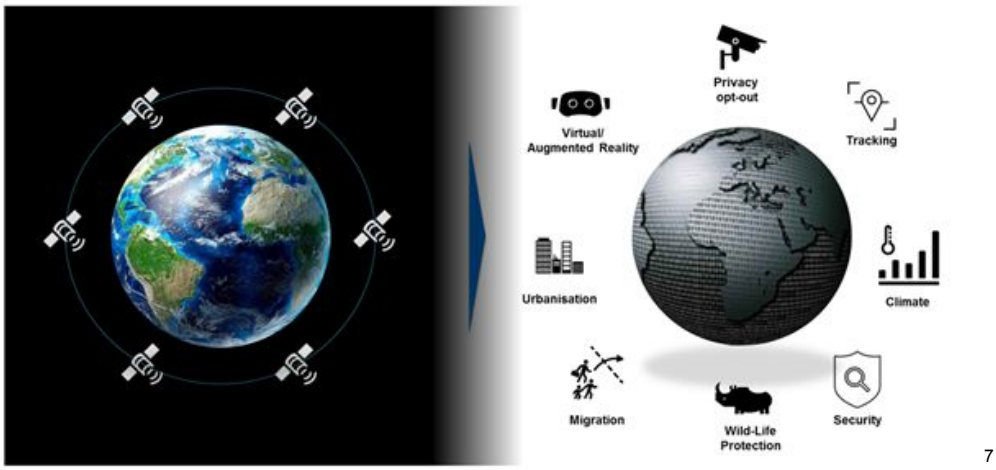
donating computer time, resources etc.) Simple Archeons could then send back information like sensor readings, pictures, video, or broadband access in return for this funding.

Similar to De Filippi's Plantoids, Archeons will reproduce when they reach a certain amount of funding, compensating the original creators with a predetermined percentage of the funding and using the remaining funds to give birth to a new Archeon by sending a request for proposals to create the next version, and rewarding the winning idea with the funding collected. While these proposals can be submitted by anyone, they must be congruent with the original Archeon's DNA, or the logic and rules that govern its growth and reproduction set by the original creator. These rules can define things like what the Archeon must be used for (scientific research, network access), what types of materials can be used, how much dividends the Archeon's offspring must pay to contributors, and what the voting process looks like for reproduction. Anyone submitting a proposal must comply with these initial requirements but are free to develop their ideas, create new use-cases, and set further rules for future descendents.

As plantoids, Archeons follow a darwinist approach, meaning that different people in different geographic locations and cultures can create distinct versions, whose offspring will conform to their goals and desires for space exploration and utilization. This allows Archeons to evolve into multiple branches, each with their own unique characteristics and use cases. From this perspective, each Archeon is based on an evolutionary algorithm, where new Archeons experiment with different purposes, builds, and governance mechanisms based on their environment. Only those that are successful will survive. For this reason, Archeons represent a radically non-human business model in that they incentivize the reproduction of shareholder value, rather than converting profit into shareholder value. The people who create future Archeons will not only receive the funds to produce it, but also a small proportion of all funds collected from the Archeon they created and its descendants. Humans are thus incentivized to cooperate and collaborate rather than compete, not only creating the best Archeon possible, but actually encouraging others to remix and improve upon their design in future iterations. A single successful Archeon can't use a good idea to monopolize markets, its success (from a shareholder's perspective) will depend on the number and success of its descendents.

The first Archeons will be simple and require a significant up-front investment in time, money, and energy by creators. But as their notoriety and success grow, more ambitious projects could be undertaken. Archeons can be implemented today as nano-satellites that give those not employed by large corporations or governments access to real-time, trustworthy data about on earth systems such as weather, climate information, migration information and more.[6]

[6] Stocker, Carston. "This isn't sci-fi: A space-based sharing economy powered by nano-satellites could save humanity." World Economic Forum. March 31, 2017. Accessed May 13, 2017. https://www.weforum.org/agenda/2017/03/sharing-economy-space-blockchain/.



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Nanosatellites are smaller, lighter, and less expensive than those used by governments and industry, and can be built using standard or machine-fabricated parts accessible by many, especially as digital fabrication technology improves. But Archeons could go way beyond satellites. In the future, an Archeon could be used to seed a research station, space colony, or even a whole civilization. As a DAO, each Archeon can act as an autonomous entity mediating the rules and protocols its stakeholders agree to abide by, rather, a system of government. These rules could be financial, economic, political, cultural, or even environmental, supporting a wide variety of models for self-governance and organization. Imagine a self-funded space station where members earn and use cryptocurrency to access supplies and resources. If enough members disagree with the Archeons contractual rules, they can vote to create a new offspring, more in alignment with their goals and vision. A splinter civilization can fork off that conforms to how they want to interact with one another.

Archeons are a speculative exercise attempting to solve for a real lack of diversity in practical narratives for near-space exploration. Since even getting to space is expensive, most individuals are unable to access it, only allowing for well-funded and well-organized corporations to define how, why, and when space exploration will occur. If space really is a commons, there must be a way that common people can work together to access its benefits, and its responsibilities. Archeons achieve this goal, but are unique in that they rely on a plantoid versus android, or plant vs. human definition of collective intelligence to reach it. In this way, they represent a xenosectionalist intervention into traditional human-centric organizational structures. They not only harness the very real potential of the emerging blockchain protocol to run autonomous code for the purpose of governance between people, but they base the ‘business intelligence’ behind that governance on a non-human model. While I believe Archeons could be revolutionary in many ways, I am not so naive as to think that radicalism, violence, and horror can’t be encoded into such a system. However, perhaps by applying distributed evolutionary fitness as a framework for the reproduction and survival of our ideas, the most terrifying dreams lurking within humanity can be weeded out before we make it too far out of orbit.

[7] Ibid.

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